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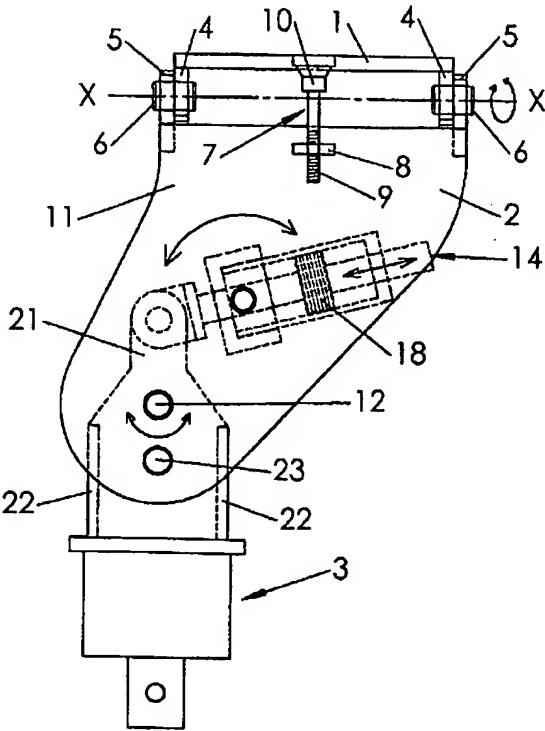
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[Continued on next page]

(54) Title: DAMPENING APPARATUS



(57) Abstract: Dampening means (14, 18) for a tool (3), the dampening means (14, 18) controlling pivoting of the tool (3) with respect to a support means of a support structure (10).

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**Published:**

- *with international search report*
- *with amended claims*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**DAMPENING APPARATUS****TECHNICAL FIELD**

This Invention relates to dampening apparatus and has particular relevance to apparatus used for dampening or otherwise controlling  
5 the movements of elements of equipment and machinery.

**BACKGROUND ART**

Agricultural and construction equipment and machinery is often used in situations where the personal safety of operators and others within the vicinity of the machinery is of primary importance.

10 Many types of machinery such as that used for drilling, digging, cutting and the like a tool is suspended from a boom arm or other form of support.

15 Rotatable auger devices or example are generally suspended from booms and engineered so that the auger can be set up to drill vertical holes in required positions despite the fact that the surrounding terrain may mean that the vehicle to which the device is attached is not on a level surface.

20 To accommodate various types of terrains and conditions the augers are normally suspended so that they are able to freely swing on intersecting planes.

When drilling is not taking place and the vehicle or boom arm is being moved, the augers can pendulate in a largely uncontrolled manner creating a particularly dangerous potential impact situation for the operator and persons or property nearby.

25 Drilling augers are not the only types of equipment where tools are able to pendulate in a dangerous manner, other examples being pile drivers, mowing, cutting and digging equipment.

It is an object of the present invention to provide a support structure for a tool where pendulation of the tool with respect to a supporting  
30 device is controlled and/or inhibited.

Further objects and advantages of the present invention will become apparent from the ensuing description which is given by way of

example.

#### DISCLOSURE OF INVENTION

According to the present invention there is provided a support structure for a tool said support structure comprising support means, a 5 pivoted link supporting said tool from the support means and dampening means which controls pivoting of the tool with respect to the support means.

The dampening means may be a hydraulic or pneumatic cylinder.

10 The dampening means may be supplemented by other means, such as mechanical restraint.

15 The dampening means may be a ram having a cylinder chamber, a piston within the cylinder chamber, and a by-pass conduit providing communication to the interiors of the cylinder chamber on both sides of a piston within the chamber, and control means interposed in the by-pass conduit said control means being adjustable to control the interchange of fluids to and from the interiors of the cylinder.

20 According to a further aspect of the present invention the control means may be a valve having a valve stem within a valve passage said stem being adjustable to control the passage of fluids throughout the valve passage.

According to a further aspect of the present invention there is 25 provided a support structure for a tool said support apparatus comprising a boom, a first pivoted link supporting the tool from the boom and enabling it to swing in a first plane and a second plane at right angles to the first plane dampening means controlling the pivoting of the tool relative to the boom.

It should be appreciated that the present invention provides a dampening apparatus which is adjustable to control the movements of many different forms of suspended tool whilst they are in an active or inactive state.

#### BRIEF DESCRIPTION OF THE DRAWINGS

30 Aspects of the present invention will now be described with reference to the accompanying drawings in which;

Figures 1 and 2 are side and plan views of one form of

apparatus according to the present invention, and

Figures 3 and 4 are side and plan views of a dampening cylinder according to a further aspect of the present invention, and

5 Figures 5, 6 and 7 are circuit diagrams showing possible variations in hydraulic control circuits for apparatus of the present invention.

With respect to figures 1 to 4 of the drawings, one form of apparatus according to the present invention may comprise a frame 1 which can be mounted on a boom arm or other form of vehicle mounted support (not shown), an elbow 2 pivoted mounted to the frame 1.

10 The elbow 2 can pivotably supports a tool generally indicated by arrow 3.

The arrangement illustrated is such that the tool 3 is able to pivot with respect to the frame 1 in a first axis X:X and also with respect to the elbow on a second intersecting axis Y:Y which is at ninety degrees to the first axis X:X.

15 The frame 1 is provided with two spaced lugs 4 and corresponding lugs 5 of the elbow 2 are pivotably connected to the lugs 4 on axis X:X by pins 6.

20 A mechanical stop indicated by arrow 7 can be fixed to one or both sides of the elbow 2.

The stop 7 can be arranged to bear against the frame 1.

25 The stop 7 can be fixed to a plate 8 and may comprise a screw threaded manually adjustable shaft 9 and a extension 10 which can be arranged to bear against the frame 1 to control pivoting of the elbow 2 and tool 3, or to be wound back to allow free pivoting of the elbow and tool.

The mechanical dampener illustrated can be replaced by hydraulic side dampening systems later illustrated and described herein in relation to figure 6.

30 The elbow 2 can include two spaced plates 11 and is pivotably connected to the plates via pivot pins 12 and lugs 13. This is typical of existing arrangements on existing "non-dampened" apparatus.

By extending the lugs 13 the lugs can be pivotably engaged with

a hydraulic or pneumatic dampening or control cylinder generally by arrow 14.

The cylinder 14 can be pivotably engaged with the plates 11 of the elbow in such a manner that pendulation of the tool on pivot axis Y:Y can be damped or controlled by the cylinder 14.

5 The cylinder 14 can comprise a tubular casing 15 attached to a collar 16 from which axles 17 pivotably engaged with plates 11 extend.

The cylinder 14 has an internal piston 18 and a piston rod 19 extends from both ends of the casing.

One end of the rod a forked attachment 29.

10 The forked rod 19 can be pivotably connected to an extension 21 of the lugs 13.

As the tool 3 pendulates on pins 12 the piston rod 19 reciprocates and the cylinder will tilt.

15 In the embodiment illustrated the lower sides of the plates 11 are provided with recesses 22 and pins 23 which extend from the tool 3 and are constrained within the recesses to prevent excessive pendulation of the tool.

Fluid connections can be made to the interiors of the cylinder 14 for the purpose of dampening or controlling pivoting movement of the tool.  
20 Figures 5, 6 and 7 of the drawings illustrate possible means of hydraulic control to the interiors of cylinders.

Figure 5 of the drawings illustrates a dampening system for pendulum mounted boring/piling units.

25 The function of this dampening system is to allow oil to bleed through a pre-set adjustable orifice between the two sides of the cylinder.

The cylinder is a double rod type cylinder to keep an equal oil volume on both sides of the piston.

30 The unit is also fitted with the indicated cross-line relief valves to allow the cylinder to move freely if it is put under excessive load from improper use.

Figure 6 of the drawings illustrates a system designed to be used as a side dampening system for pendulum mounted boring/piling units.

The function of this dampening system is to allow oil to bleed through a pre-set adjustable orifice between the two equal size dampening cylinders.

The unit is also fitted with cross-line relief valves to allow the 5 cylinders to move freely they are put under excessive load from improper use.

This unit can be used as an alternative or supplement to the mechanical side dampening unit described previously in relation to figures 1 and 2.

Figure 7 of the drawings illustrates a system which provides an ability to control the position of their drive unit. The system provides the 10 operator the ability to drive (energize coil 'A' or 'B') and hold an auger/pile at the required angle until it has sufficient depth in the ground to hold it self.

The float system can be activated by energizing coil "C", this will allow the angle between the machines boom and the drive unit to change as the auger/pile enters the ground.

15 The float works by supplying a pilot signal to open the over centre valves and allow oil to escape from the cylinder.

The oil is able to bleed between the cylinder ports through a pre-set adjustable orifice.

This bleed line is also connected via the float valve to the 20 system return line so that the cylinder can float in and out, with the oil displaced by the cylinder rod being able to come and go through to the return line.

The bleed line is also fitted with cross-line relief valves to allow 25 the cylinder to move freely if it is put under excessive load from improper use, and to limit the amount of weight that the unit can lift in the powered mode.

It will be appreciated by those skilled in the art that the dampening cylinders of the present invention can be readily adapted to be driven in situations where this may be required.

One of the major advantages of the present invention is that the 30 dampening system can be incorporated into new units or retro-fitted to existing units without major alterations being required.

Aspects of the present invention have been described by way of

example only and it will be appreciated that modifications and additions thereto may be made without departing from the scope thereof.

## CLAIMS:

1. A support structure for a tool said support structure comprising support means, a pivoted link supporting said tool from the support means and dampening means which controls pivoting of the tool with respect to the support means.
2. A structure as claimed in claim 1 wherein the dampening means is a hydraulic or pneumatic cylinder.
3. A structure as claimed in claim 1 wherein the dampening means is supplemented by a mechanical restraint.
4. A structure as claimed in claim 1 wherein the dampening means is a ram having a cylinder chamber, a piston within the cylinder chamber, and a by-pass conduit providing communication to the interiors of the cylinder chamber on both sides of a piston within the chamber, and control means interposed in the by-pass conduit said control means being adjustable to control the interchange of fluids to and from the interiors of the cylinder.
5. A structure as claimed in claim 4 wherein the control means is a valve having a valve stem within a valve passage said stem being adjustable to control the passage of fluids throughout the valve passage.
6. A structure as claimed in claim 1 said support structure comprises a boom, a first pivoted link supporting the tool from the boom and enabling it to swing in a first plane and in a second plane at right angles to the first plane the dampening means controlling the pivoting of the tool relative to the boom.

**AMENDED CLAIMS**

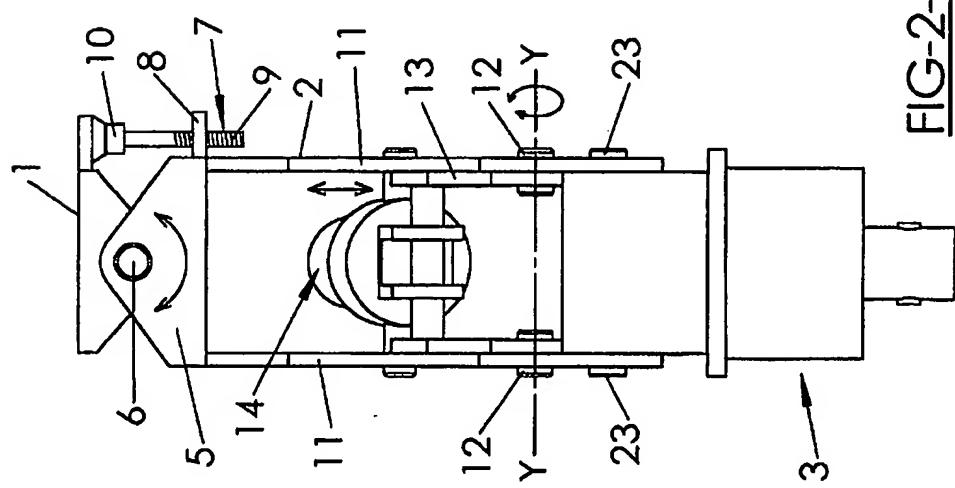
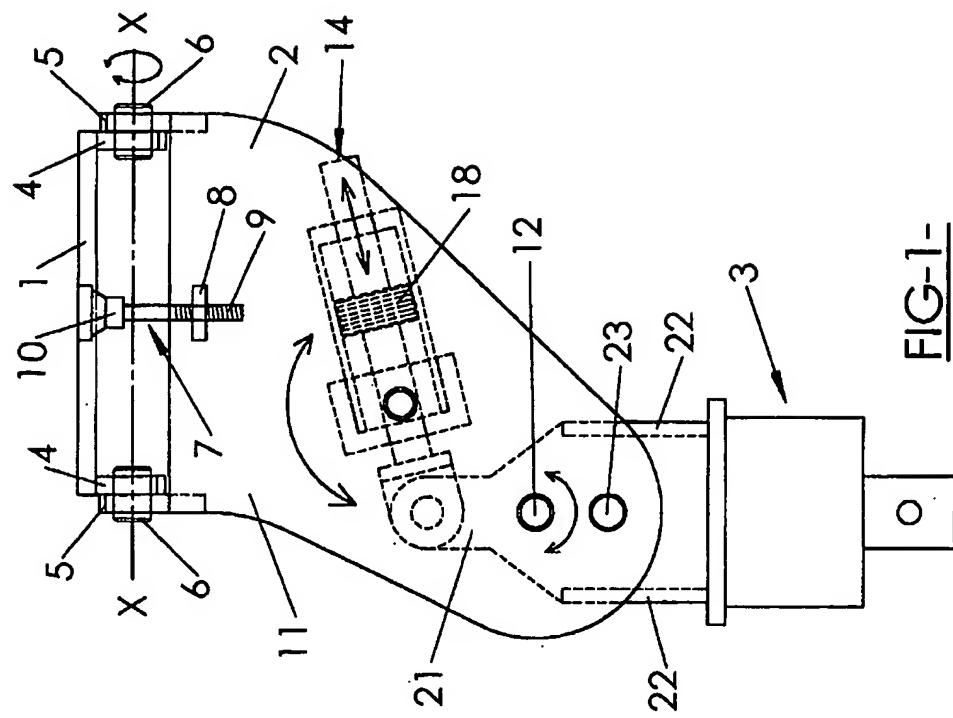
[received by the International Bureau on 30 July 02 (30.07.02);

claim 1 replaced by amended claim bearing the same number;

claims 2 to 5 unchanged; claim 6 amended; new claims 7 to 9 added; (2 pages)]

1. A support structure for a tool said support structure comprising support means, a pivoted link supporting said tool from the support means and dampening means which controls the pendulousness of the tool with respect to the support means.  
5
2. A structure as claimed in claim 1 wherein the dampening means is a hydraulic or pneumatic cylinder.
3. A structure as claimed in claim 1 wherein the dampening means is supplemented by a mechanical restraint.
- 10 4. A structure as claimed in claim 1 wherein the dampening means is a ram having a cylinder chamber, a piston within the cylinder chamber, and a by-pass conduit providing communication to the interiors of the cylinder chamber on both sides of a piston within the chamber, and control means interposed in the by-pass conduit said control means being adjustable to control the interchange of fluids to and from the interiors of the cylinder.  
15
5. A structure as claimed in claim 4 wherein the control means is a valve having a valve stem within a valve passage said stem being adjustable to control the passage of fluids throughout the valve passage.
- 20 6. A structure as claimed in claim 1 said support structure comprises a boom, a first pivoted link supporting the tool from the boom and enabling it to swing in a first plane and a second pivoted link on a second plane at right angles to the first plane and dampening means controlling the pivoting of the tool relative to the boom.
- 25 7. A structure as claimed in claim 6 wherein the first pivoted link is provided by a frame having two spaced lugs joined by a cross member, the lugs being pivotably connected to a pair of spaced plates which provide a second pivotal link with the tool, said second pivotal link comprising a frame extending from the tool which is pivotably connected to said pair of spaced plates, said dampening means being pivotably connected to the spaced plates and the frame.  
30
8. A support structure as claimed in claim 6 wherein the dampening means pivotably connected to the spaced plates is a hydraulic cylinder.

9. A support structure as claimed in claim 8 wherein a stop or stops are provided to constrain pendulation of the tool on the first plane.



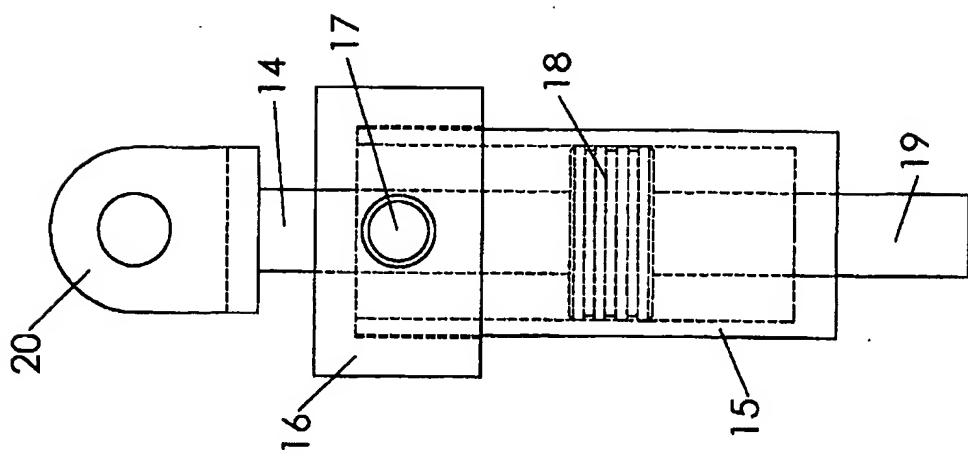


FIG-3-

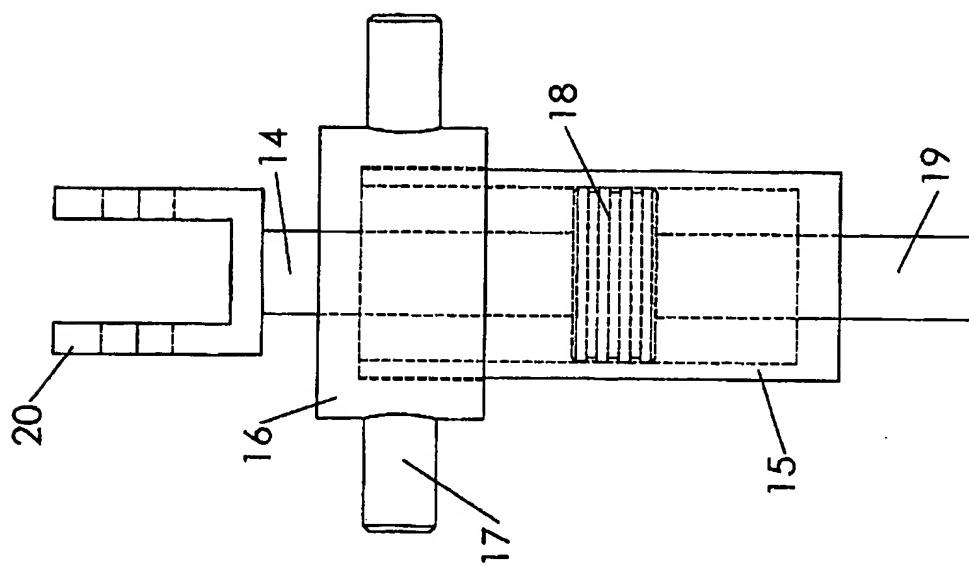


FIG-4-

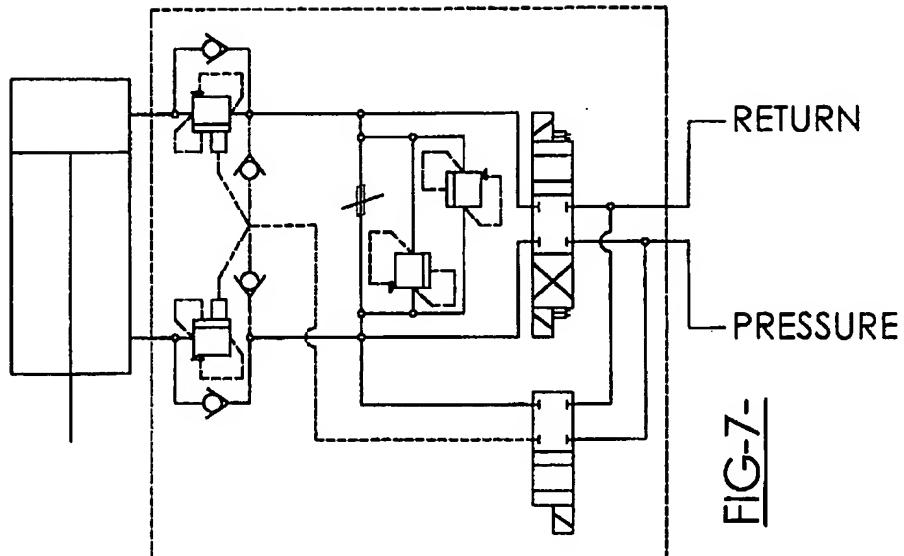


FIG-7-

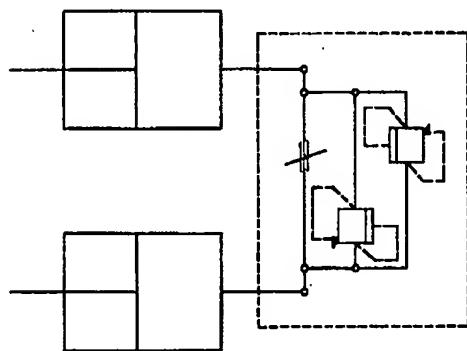


FIG-6-

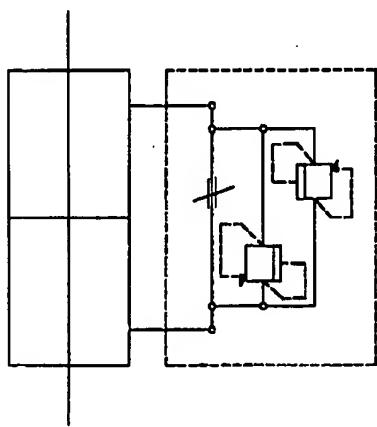


FIG-5-

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU02/00295

**A. CLASSIFICATION OF SUBJECT MATTER**

Int. Cl. 7: E02F 5/16, 5/20, 9/24; F16F 15/00, 15/023, 15/027; A01B 59/00

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

AU: IPC E02F 5/16, 5/20; F16F 15/00, 15/023, 15/027; A01B 59/00

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPAT: F16F/IC, E02F/IC, E21B/IC, E21C/IC, A01B/IC, A01C/IC AND (TOOL AND MOUNT AND PIVOT AND DAMP)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X, Y	US 4735158 A (PAUL et al) 5 April 1988 Column 1 line 59 to column 3 line 4, claim 4, figures 1 - 4	1-5
X, Y	US 4342270 A (LOFGREN et al) 3 August 1982 Column 8 line 23 to column 10 line 43, claim 1, figures 1 - 3	1-5
X, Y	US 4273056 A (LOFGREN et al) 16 June 1981 Column 5 line 22 to column 7 line 43, claim 1, figures 1, 4 & 6	1-5

 Further documents are listed in the continuation of Box C See patent family annex

* Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"B" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search  
29 May 2002

Date of mailing of the international search report

31 MAY 2002

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU02/00295

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X, Y	US 4060043 A (LOFGREN) 29 November 1977 Column 1 line 63 to column 4 line 6, claim 2, figures 1 - 8	1-5
X, Y	US 3321031 A (EVANS et al) 23 May 1967 Whole document	1-5
Y	US 4288196 A (SUTTON) 8 September 1981 Whole document	5
	Note: Disclosure of the last citation when combined together with the disclosure of any one of the previous citations make the application defined in claim 5 obvious.	

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

PCT/AU02/00295

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	4735158	CA	1250185				
US	4342270	CA	1151953	FI	810488	SE	8004686
US	4273056	CA	1108016	DE	2919962	FI	791544
		SE	7805797				
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		DE	2455759	FI	3428/74	JP	50087816
		NO	744289	SE	7316167	ZA	7406969

END OF ANNEX